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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,231	01/27/2004	Ardeshir Riahi	H0006763--1170	2931

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EXAMINER

VERDIER, CHRISTOPHER M

ART UNIT	PAPER NUMBER
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3745

DATE MAILED: 02/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

SP

Office Action Summary	Application No.	Applicant(s)	
	10/766,231	RIAH ET AL.	
	Examiner	Art Unit	
	Christopher Verdier	3745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3-29-04, 6-24-05</u> . | 6) <input type="checkbox"/> Other: ____. |

Information Disclosure Statement

The information listed on the Information Disclosure Statements of March 29, 2004 and June 24, 2005 has been crossed out by the examiner, because most of the patent numbers listed are illegible. All references listed thereon have been considered and are listed by the examiner on form PTO-892.

Specification

The disclosure is objected to because of the following informalities: Appropriate correction is required.

In paragraph 7, line 3, "area of," should be changed to -- area, of --.

In paragraph 7, line 12, "constrains" should be changed to -- constraints --.

In paragraph 10, line 1, -- a -- should be inserted after "only,".

In paragraph 30, line 7, "502extends" should be changed to -- 502 extends --.

In paragraph 31, line 3, "601" should be changed to -- 602 --.

In paragraph 31, line 12, "702" should be changed to -- α_2 --.

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:

Claim 3, lines 1-3, which recite that the compound angle of each film cooling hole centerline comprises at least a first angle formed with respect to a first predetermined datum structure, has no antecedent basis in the specification for the underlined limitation.

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Claim 7, lines 3-5, which recite the mounting section including one or more coolant flowpaths extending therethrough and in fluid communication with one or more of the internal coolant channels, has no antecedent basis in the specification.

Claim 10, which recites that the predetermined minimum distance is between about two and about four times a hole diameter, has no antecedent basis in the specification.

Claim 12, lines 1-4, which recite “the compound angle of each film cooling hole centerline comprises at least (i) a first angle formed with respect to the first datum structure and (ii) a second angle formed with respect to the second datum structure”, has no antecedent basis in the specification for the underlined limitation.

Claim 16, line 2, which recites the compressor having an inlet and an outlet, has no antecedent basis in the specification.

Claim 16, lines 4-5, which recite that the combustor receives at least a portion of the compressed air from the compressor outlet, has no antecedent basis in the specification.

Claim 16, lines 7-8, which recite that the turbine receives at least a portion of the compressed air from the compressor, has no antecedent basis in the specification for the underlined limitation.

Claim 18, lines 1-3, which recite that the compound angle of each film cooling hole centerline comprises at least a first angle formed with respect to a first predetermined datum structure, has no antecedent basis in the specification for the underlined limitation.

Claim 22, which recites the mounting section including one or more coolant flowpaths extending therethrough and in fluid communication with one or more of the internal coolant channels, has no antecedent basis in the specification.

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Claim 25, which recites that the predetermined minimum distance is between about two and about four times a hole diameter, has no antecedent basis in the specification.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: “d1” and “d2” (paragraph 31). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 11-15 are objected to because of the following informalities: Appropriate correction is required.

In claim 11, line 7, “outersurface” should be changed to -- outer surface --.

In claim 15, line 3, -- the -- should be inserted after “intersect”.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 14-15 and 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 14, line 8, “thereto” is indefinite in that it is unclear if this refers to the first locator plane, the first predetermined distance, or the predetermined direction. In claim 14, last line, “thereto” is indefinite in that it is unclear if this refers to the second locator plane, the second predetermined distance, or the predetermined direction. In claim 22, lines 2-3, “the upstream sidewall bottom edge and the downstream sidewall bottom edge” is unclear if this is meant to refer to the airfoil or not, because claim 16 from which claim 22 depends does not recite any sidewall.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7, 11-13, and 16-22 (as far as claim 22 is definite and understood), are rejected under 35 U.S.C. 102(b) as being anticipated by Glynn 6,206,638 (figures 1-3). Note the turbine blade 10 for a gas turbine engine, comprising an airfoil 12 having an outer surface, a bottom

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edge, and a top edge, a plurality of internal cooling channels 60, 62 formed in the airfoil, and a plurality of film cooling holes 48 extending through the airfoil and in fluid communication with one of the internal cooling channels, the plurality of film cooling holes arranged into at least two adjacent rows, each row disposed on at least a portion of a line that extends between the airfoil top and bottom edges, and each film cooling hole having a centerline extending therethrough, wherein the centerline of each film cooling hole forms a compound angle with respect to a tangent of the airfoil outer surface (column 8, lines 5-7), and a distance between the centerlines of each film cooling hole is at least a predetermined minimum distance (because the blade is manufactured, the distance is known to be a predetermined minimum distance). Each film cooling hole in each row is offset from each of the film cooling holes in the adjacent row, and the compound angle of each film cooling hole centerline comprises a first angle formed with respect to a first predetermined datum structure SL and a second angle formed with respect to a second predetermined datum structure 11. Each film cooling hole has an inlet port and an outlet port, and the outlet port of each film cooling hole is located a first predetermined distance from the first datum structure and a second predetermined distance from the second datum structure. The first and second predetermined datum structures are first and second datum planes, respectively and the planes are disposed perpendicular to one another. A mounting section 14 is coupled to the airfoil bottom edge and is adapted to couple to a turbine wheel, the mounting section including one or more coolant flowpaths 42 extending therethrough and in fluid communication with one or more of the internal coolant channels. Also disclosed is a method of forming the plurality of film cooling holes in the turbine airfoil having the outer surface and the plurality of internal cooling channels, the method comprising the steps of defining the first datum structure

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and the second datum structure, forming each of the plurality of film cooling holes through the airfoil, and into fluid communication with one of the internal cooling channels, at a location on the airfoil outer surface relative to the first and second datum structures, each film cooling hole having the centerline extending therethrough that forms the compound angle with respect to the tangent of the airfoil outer surface, with the compound angle of each film cooling hole centerline comprising the first angle formed with respect to the first datum structure and the second angle formed with respect to the second datum structure. The first and second datum structures are the first and second datum planes, respectively, and each film cooling hole is located at a position relative to the first and second datum planes. Also disclosed is a gas turbine engine (not shown), comprising a compressor having an inlet and an outlet and operable to supply compressed air, a combustor coupled to receive at least a portion of the compressed air from the compressor outlet and operable to supply combusted air, and a turbine having the plurality of turbine blades coupled to and extending radially therefrom, the turbine coupled to receive the combusted air from the combustor and at least a portion of the compressed air from the compressor, with each turbine blade having the above features. The mounting section is coupled to the upstream airfoil sidewall bottom edge and the downstream airfoil sidewall bottom edge.

Claims 1-8, 11-13, and 16-23 (as far as claim 22 is definite and understood), are rejected under 35 U.S.C. 102(b) as being anticipated by European Patent 742,347 (figures 1-4 and 9).

Note the turbine blade 15 for a gas turbine engine, comprising an airfoil 16 having an outer surface, a bottom edge, and a top edge, a plurality of internal cooling channels 20 formed in the airfoil, and a plurality of film cooling holes 26 extending through the airfoil and in fluid

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communication with one of the internal cooling channels, the plurality of film cooling holes arranged into at least two adjacent rows, each row disposed on at least a portion of a line that extends between the airfoil top and bottom edges, and each film cooling hole having a centerline extending therethrough, wherein the centerline of each film cooling hole forms a compound angle with respect to a tangent of the airfoil outer surface (column 9, lines 16-18), and a distance between the centerlines of each film cooling hole is at least a predetermined minimum distance (because the blade is manufactured, the distance is known to be a predetermined minimum distance). Each film cooling hole in each row is offset from each of the film cooling holes in the adjacent row, and the compound angle of each film cooling hole centerline comprises a first angle formed with respect to a first predetermined datum structure (the element 28 and/or the rods 27 in figure 4 adjacent reference numeral 38) and a second angle formed with respect to a second predetermined datum structure 14. Each film cooling hole has an inlet port and an outlet port, and the outlet port of each film cooling hole is located a first predetermined distance from the first datum structure and a second predetermined distance from the second datum structure. The first and second predetermined datum structures are first and second datum planes, respectively and the planes are disposed perpendicular to one another. A mounting section 17 is coupled to the airfoil bottom edge and is adapted to couple to a turbine wheel, the mounting section including a coolant flowpath near 19 extending therethrough and in fluid communication with the internal coolant channels. The centerline of each film cooling hole forms an angle with respect to a tangent to the airfoil outer surface that is about 30 degrees (column 9, lines 18-23). Also disclosed is a method of forming the plurality of film cooling holes in the turbine airfoil having the outer surface and the plurality of internal cooling channels, the method comprising

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the steps of defining the first datum structure and the second datum structure, forming each of the plurality of film cooling holes through the airfoil, and into fluid communication with one of the internal cooling channels, at a location on the airfoil outer surface relative to the first and second datum structures, each film cooling hole having the centerline extending therethrough that forms the compound angle with respect to the tangent of the airfoil outer surface, with the compound angle of each film cooling hole centerline comprising the first angle formed with respect to the first datum structure and the second angle formed with respect to the second datum structure. The first and second datum structures are the first and second datum planes, respectively, and each film cooling hole is located at a position relative to the first and second datum planes. Also disclosed is a gas turbine engine 10, comprising a compressor 11 having an inlet and an outlet and operable to supply compressed air, a combustor 12 coupled to receive at least a portion of the compressed air from the compressor outlet and operable to supply combusted air, and a turbine 13 having the plurality of turbine blades coupled to and extending radially therefrom, the turbine coupled to receive the combusted air from the combustor and at least a portion of the compressed air from the compressor, with each turbine blade having the above features. The mounting section is coupled to the upstream airfoil sidewall bottom edge and the downstream airfoil sidewall bottom edge.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 9 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over European Patent 742,347 in view of Graham 4,384,823. The European Patent discloses a turbine blade and a gas turbine engine substantially as claimed as set forth above, including compound angled film cooling holes that form an angle of about 30 degrees with respect to the tangent to the airfoil outer surface.

However, the European Patent does not disclose that the angle is less than about 20 degrees.

Graham (figure 1) teaches that the angle 20 that film cooling holes 16 make with respect to a tangent to an airfoil outer surface is from about 15 to 45 degrees, for the purpose of providing increased effectiveness in film cooling.

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It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the film cooling holes of the European Patent 742,347 such that they make an angle of less than 20 degrees with respect to the tangent to the airfoil outer surface, as taught by Graham, for the purpose of providing increased effectiveness in film cooling.

Claims 10 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over European Patent 742,347 in view of Green 5,374,162. The European Patent discloses a turbine blade and a gas turbine engine substantially as claimed as set forth above, including a predetermined minimum distance between the centerlines of each film cooling hole, but does not disclose that the predetermined minimum distance is between about two and four times a hole diameter.

Green (figures 2-5) shows a cooled turbine blade 16 having film cooling holes 38 which are spaced apart by their centerlines a predetermined minimum distance C which is between approximately three and five times a hole diameter, for the purpose of providing effective film cooling while not weakening the turbine blade.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to form the film cooling holes of the European Patent 742,347 such that the predetermined minimum distance is between about two and four times a hole diameter, as taught by Green, for the purpose of providing effective film cooling while not weakening the turbine blade.

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Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Starkweather is cited to show a turbine blade with compound angle film cooling holes. This reference could also have been applied as it anticipates at least claim 1, but is not applied at this time to avoid multiple rejections.

Kildea and Herman are cited to show cooled turbine blades with inlets in the mounting section.

Allowable Subject Matter

Claims 14-15 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

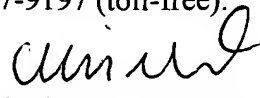
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Verdier whose telephone number is (571) 272-4824. The examiner can normally be reached on Monday-Friday from 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward K. Look can be reached on (571) 272-4820. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C.V.
January 23, 2006



Christopher Verdier
Primary Examiner
Art Unit 3745